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JUN 26 2003

Federal Communications Commission
Office of Secretary

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June 26, 2003

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 Twelfth Street, S.W.
Washington DC 20554

Re: WT Docket No. 02-55
Ex Parte Presentation

Dear Ms. Dortch:

On Wednesday, June 25, 2003, Donald Appleby, Director, Radio Project Office, Governor's Office of Administration, Commonwealth of Pennsylvania, C. Keith Leto, Project Coordinator, Radio Project Office, Governor's Office of Administration, Commonwealth of Pennsylvania, Victor Ramage and Norm Coltri of RCC Consultants, Stuart Shorenstein and the undersigned of Wolf, Block, Schorr and Solis Cohen, met with John Muleta, Chief, Wireless Bureau, Jeanne Kowalski, Deputy Chief, Public Safety and Private Wireless Division, Scott Delacourt, Chief of Staff, Wireless Bureau, Tom Stanley, Chief Engineer, Wireless Bureau, Michael Wilhelm, Senior Attorney, Wireless Bureau and Shellie Blakeney, Legal Advisor, Wireless Bureau, regarding the Commission's above-captioned rulemaking on public safety communications in the 800 MHz band.

In a separate meeting on June 25, this group met with Bryan Tramont, Senior Legal Advisor to Chairman Powell, and Trey Hanbury, Office of General Counsel, to discuss the same issues in the above-referenced docket.

Finally, the same group met to discuss the same issues with the following members of the Office of Engineering and Technology: Ed Thomas, James D. Schlichting, Rodney Small, Michael J. Marcus, Robert Bromery, Rashmi Doshi, Ira R. Keltz, Geri Matise, Saurbh Chhabra, Salomon Satche, Bruce Romano and William Hurst.

During our meetings we discussed the Commonwealth of Pennsylvania's concerns regarding the "Consensus Plan" and other issues regarding 800 MHz interference. Attached is

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Wolf, Block, Schorr and Solis-Cohen LLP

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Ms. Marlene H. Dortch
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the written presentation and outline of those concerns and issues as raised and discussed in the meetings.

The Commonwealth of Pennsylvania is continuing to gather additional information which it intends to provide to the Commission at a future date.

Pursuant to Section 1.1206 of the Commission's rules, 47.C.F.R. §1.1206, an original and one copy of this letter including attachments are being filed with your office.

Very truly yours,

A handwritten signature in black ink, appearing to read 'David E. Bronston', with a long horizontal flourish extending to the right.

David E. Bronston
For WOLF, BLOCK, SCHORR and SOLIS-COHEN LLP

DEB/wdj2623
Attachment

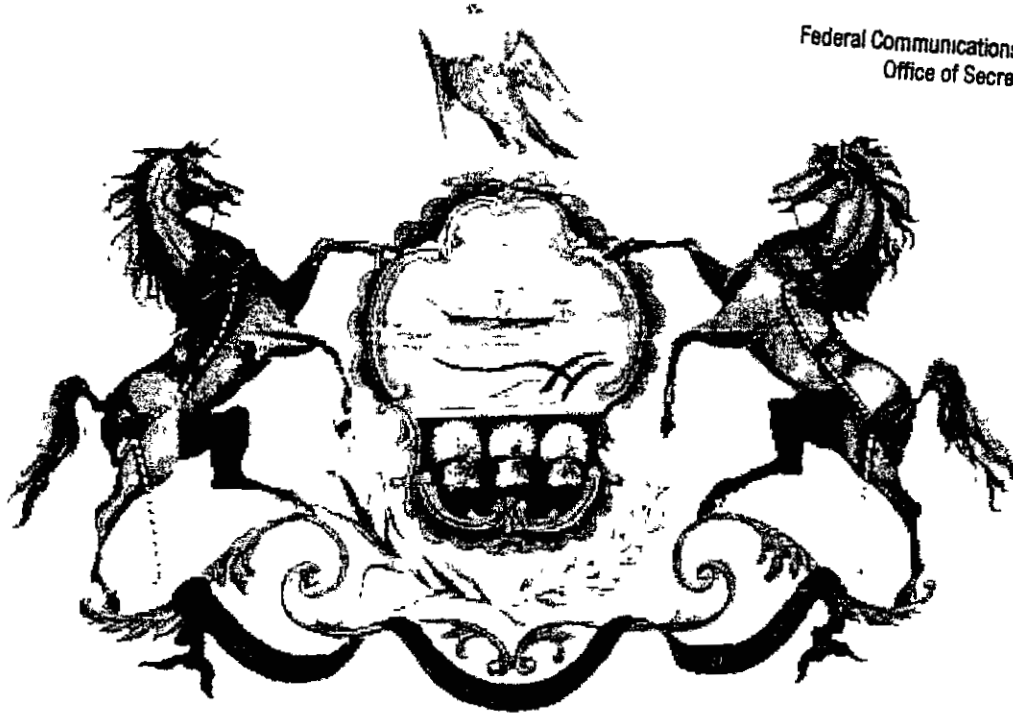
cc: John Muleta
Jeanne Kowalski
Scott Delacourt
Tom Stanley
Michael Wilhelm
Shellie Blakeney
Bryan Tramont
Trey Hanbury
Ed Thomas
James Schlichting
Rodney Small
Michael J. Marcus
Robert Bromery
Rashmi Doshi
Ira R. Keltz
Geri Matise
Saurbh Chhabra
Salomon Satche
Bruce Romano
William Hurst

***Commonwealth of Pennsylvania
Public Safety Communications Network***

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**Federal Communications Commission
Office of Secretary**



***Presentation to the Federal Communications Commission
Regarding 800 MHZ Interference***

***Presented by Donald Appleby
Director, Radio Project Office
Governor's Office of Administration
Robert S. Barnett, Secretary of Administration
Commonwealth of Pennsylvania***

The Commonwealth of Pennsylvania is building and operating the largest public safety radio network in North America.

•In 1996 the Commonwealth launched a program to modernize to an advanced, state of the art, wireless public safety voice and data communications network.

•The Commonwealth's investment is leveraged by providing a framework for shared communication among emergency service agencies throughout the Commonwealth. It serves over 25,000 radio users in state, county and local government entities.

•The network cost over \$400M to build and costs \$14M to manage and operate annually. The network will consist of 1,400 transmitters, deployed on over 240 high-profile towers and over 700 low profile (low ERP) "micro sites".

•It is a "Hybrid" system that is not explicitly addressed by the Consensus Plan or the Commission's comments.

- Over 80% of the coverage, and over 95% of the capacity, is provided by traditional high-profile moderate ERP tower locations.
- The remainder of the coverage is provided by low-profile low ERP locations on utility poles, rooftops, and other locations. These sites efficiently and effectively fill in coverage gaps from the high profile sites.

Pennsylvania Radio System Participants

- * **Homeland Defense**
- * **State Police**
- * **Emergency Management Agency**
- * **National Guard / Military & Veterans Affairs**
- * **Health**
- * **Office of the Attorney General**
- * **Capitol Police**
- * **Corrections**
- * **Board of Probation & Parole**
- * **Environmental Protection**
- * **Public Utility Commission**
- * **Fish & Boat Commission**
- * **Game Commission**
- * **Turnpike Commission**
- * **Conservation and Natural Resources**
- * **Transportation**
- Public Welfare**
- Agriculture**
- Revenue**
- Historical and Museum Commission**
- Labor & Industry**
- Inspector General**
- General Services**
- Education**
- State System of Higher Education**
- * **Cumberland County**
- * **Lancaster County**
- * **Huntingdon County Sheriff**
- First Energy**
- North Central Area Transportation Authority**

* Denotes Law Enforcement or Homeland Defense agency

Pennsylvania's Concerns with the Consensus Plan (and other Relocation Plans):

1. The Consensus Plan proposes to relocate systems that are not "cellular" in architecture, and defines this by site overlap and antenna height criteria. Elsewhere, the Consensus Plan refers to relocation of all public safety systems in the 800 MHz band. The Commonwealth's system is a hybrid system, consisting of both high profile and low profile sites. The Consensus Plan's definition may be interpreted as excluding the Commonwealth's system from any remediation. Also, the Pennsylvania system includes B-I/LT licensed frequencies by way of FCC waiver that are excluded from protection by the Consensus Plan.
2. The Consensus Plan implies that interference is generated by all commercial carriers, that it is caused predominately by receiver intermodulation and less so by out-of-band emissions, and that the out-of-band emissions are unavoidable except by physically relocating band segments. The Commonwealth's experience is that no commercial carrier other than Nextel has been identified as interfering with its system, that we are not experiencing receiver front end intermodulation interference at all, and that Nextel's out-of-band emissions are so severe and widespread that band relocation may not alleviate the interference (See Motorola's Ex Parte 5-29-03, Page 10).
3. The Consensus Plan purports to provide for financial support for a relocation effort by reserving funds to offset costs. The Commonwealth believes, based on its estimates, that the funds reserved are inadequate to offset the direct costs of relocation. Further, the Commonwealth notes that no effort is identified to offset the Commonwealth's indirect costs.
4. Without provision for unused spectrum to allow unimpeded transition, implementation of the Consensus Plan will severely disrupt public safety communications during the transition period.
5. Implementation of new or additional channel allocation standards or requirements (such as channel spacing or bandwidth changes) during a forced transition will have a severe adverse impact on Pennsylvania's system.

Discussion of Points:

1. The Consensus Plan proposes to relocate systems that are not “cellular” in architecture, and defines this by site overlap and antenna height criteria. Elsewhere, the Consensus Plan refers to relocation of all public safety systems in the 800 MHz band. The Commonwealth’s system is a hybrid system, consisting of both high profile and low profile sites. The Consensus Plan’s definition may be interpreted as excluding the Commonwealth’s system from any remediation. Also, the Pennsylvania system includes B-I/LT licensed frequencies by way of FCC waiver that are excluded from protection by the Consensus Plan

- The Pennsylvania system was conceived of and designed as an interference-limited system. As a hybrid system, it uses both high-profile high-ERP sites and many low-profile, low-ERP sites.
- The majority of the comments and presumptions in this proceeding to date have addressed technical issues from a county or small regional basis, not from a statewide basis. Spectrum planning and allocation issues are severely challenging for statewide systems, and often represent hard-wrought compromises between adjacent jurisdictions.
- The Commonwealth of Pennsylvania recognized this from the onset of system planning, resulting in a system architecture that is both flexible and spectrum-efficient without requiring the allocation of large geographic blocks of channels as in simulcast systems. Further, the Commonwealth’s system is pioneering the use of automatic, full-duplex in band vehicular repeaters to extend coverage into dense urban structures without requiring wholesale increases in street-level signal strength. Both of these architectural changes challenge assumptions made in this Proceeding regarding appropriate public safety system designs and their associated ability to deal with intermodulation interference (see FCC 02-81, para. 12).
- Failure to recognize Pennsylvania’s system by exclusion from remediation penalizes Pennsylvania for its innovative approach to diminished spectrum availability
- Pennsylvania is currently operating over 50 low-profile transmitter sites at locations throughout the Commonwealth. The majority of these sites are located in the southeast quadrant of the state, in the area with the most frequency congestion and the highest number of co-channel users. Many of these low-profile sites have been on the air since March, 2000. These sites typically are operated at 100 watts ERP or less. Significantly, the Commonwealth has received no complaints of interference to either commercial or public safety radio users from these low profile transmitters.
- The low profile sites, although frequency agile, use active transmitter filtering to reduce out-of-band emissions

2. The Consensus Plan implies that interference is generated by all commercial carriers, that it is caused predominately by receiver intermodulation and less so by out-of-band emissions, and that the out-of-band emissions are unavoidable except by physically relocating band segments. The Commonwealth's experience is that no commercial carrier other than Nextel has been identified as interfering with its system, that we are not experiencing receiver front end intermodulation interference at all, and that Nextel's out-of-band emissions are so severe and widespread that band relocation may not alleviate the interference (See Motorola's Ex Parte 5-29-03, Page 10).

- Pennsylvania's system currently has over 1500 voice users and over 1000 mobile data users. Users are active statewide, but are most active in the region between Harrisburg and Philadelphia in the southeast quadrant of the state. This quadrant is also the most densely populated area of the state, and is the most challenging RF environment statewide. Users have been active on the system in this region since March of 2000.
- Despite a large amount of coverage testing, system use, and coexistence with many other 800 MHz systems, the only interference experienced and identified to date has been traced to Nextel transmitter locations. No other interference has been identified, and no impact to the State's system has been traced to other licensees.
- Pennsylvania and its partners have identified Nextel-originated interference at many locations. In the area subjected to the most intense testing (Dauphin and Cumberland Counties, near Harrisburg), over a dozen sources of interference have been identified to both NPSPAC and non-NPSPAC channels.
- Of particular concern are the sites where Nextel interference to Pennsylvania NPSPAC channels is occurring. At several of these sites, the Commonwealth has recorded out of band emissions in the form of wideband noise at levels greater than -90 dBm at frequencies over 1.5 MHz removed from the nearest Nextel carrier while over ¼ mile from the Nextel transmitter site. The cited measurement is not unique among those investigated. Recorded OOB at these levels and over this wide a spectrum call into question the ability of spectrum reallocation to do more than move interference.
- These findings call into question both Nextel's assertion that intermodulation is the primary interference mechanism (Nextel Proposal, Nov 21, 2001, at 21) and that it is due entirely to public safety receiver characteristics. Neither grossly increased received signal levels nor improved receiver front end performance will alleviate wideband noise levels that are increased 15 to 20 dBm above their thermal levels.
- Many commenters have urged the FCC to adopt a proactive, preventative approach towards future interference rather than any approach that only addresses the causes of interference raised in this particular proceeding.

- The Commonwealth agrees with the general concept of segregation of spectrum allocations contained in several of the plans proposed to date. However, we strongly believe that the Commission must specify an aggregate OOB limit for all transmitters for a given licensee at a site, and require that such limits be applied retroactively (FCC 02-81 at 75).

3. The Consensus Plan purports to provide for financial support for a relocation effort by reserving funds to offset costs. The Commonwealth believes, based on its estimates, that the funds reserved are inadequate to nationally offset the direct costs of relocation. Further, the Commonwealth notes that no effort is identified to offset the Commonwealth's indirect costs.

- Pennsylvania's system will have over 1400 transmitters when finalized. Pennsylvania estimated its costs for frequency relocation using the following assumptions:
 - a. One visit per transmitter site, with one move to a new frequency.
 - b. All new frequencies within the same band as the current frequency.
 - c. No change in antenna patterns, coverage, or capacity introduced as a result of the frequency changes.
 - d. Identical or better interference levels at the new frequencies.
 - e. No changes in any hardware due to the frequency migration

Pennsylvania estimates its direct cost at approximately \$12 million provided these assumptions are correct. Given that no unused spectrum has been identified to use to facilitate the relocation, it is likely that more than one intermediate move per transmitter will be required with a corresponding multiplication of the cost. Pennsylvania believes that it is highly likely that its entire system cannot be relocated in one operation, resulting in many visits to each site and many iterations of subscriber reprogramming before completion. A reasonable estimate of actual costs for Pennsylvania's relocation is approximately \$55 million.

- Indirect costs are estimated to be significant. Pennsylvania's system is unique in allowing over-the-air reconfiguration and reprogramming of mobile and portable radios, but even with this tool available relocation on-the-fly without disruption of either capacity or coverage requires close coordination with all active users. The Commonwealth estimates that the indirect cost to Pennsylvania for relocation may exceed the direct costs.

4. Implementation of any Plan requiring channel relocation is likely to severely disrupt public safety communications on live systems.

- As noted previously, any estimate of the effort associated with implementation of the Consensus Plan must rely on independent assumptions regarding some undefined aspects of the Plan. Pennsylvania is concerned that the Plan does not address some aspects in sufficient detail to ensure that its critical public safety communications are not interrupted
 - a. What spectrum will be used to implement the initial frequency swaps? No “Green Space” (temporary holding space) appears to be available for interim migration of frequencies. Close-spacing or temporary allocations are unlikely to provide the same performance.
 - b. Many of Pennsylvania’s partners use non-NPSPAC channels, with some on commercial frequencies and others on B-I/LT channels included by FCC waiver. These channels are integrated into the overall system design, including mixed use at trunked transmitter sites. Are these licensees included in the Consensus Plan’s remediation?
 - c. The administration of the relocation funds is poorly defined. Pennsylvania is concerned that management of the funds by national organizations whose membership is predominately smaller jurisdictions, may be problematic and subject to favoritism and discriminatory outcomes.
 - d. Public safety systems cannot easily tolerate reductions in capacity during any transition. Consideration of a transition using only a small pool of channels presents severe challenges in the logistics of reconfiguring subscriber devices, network management software and hardware, and network interconnections.
 - e. Pennsylvania’s border with Canada presents special challenges for the development of high-profile, high-ERP sites. The Commonwealth has just concluded a lengthy and difficult process with New York State to coordinate the use of 800 MHz NPSPAC channels in the Lake Erie region.

5. Implementation of new or additional channel allocation standards or requirements (such as channel spacing or bandwidth changes) during a forced transition will have a severe adverse impact on Pennsylvania's system.

- The Pennsylvania system is currently constructed using 20 kHz occupied bandwidth and a 12.5 kHz channel spacing (NPSPAC) for the majority of the licensed transmitters, with a smaller number using 25 kHz spacing. These frequencies are used in a TDMA architecture capable of supporting either two or four concurrent time slots per 20 or 25 kHz license.
- Wholesale alteration of the channel bandwidth at 800 MHz to either a 6.25 or 12.5 kHz divisor at this point may have an adverse impact both with system gain and coverage (in the case of reduction of bandwidth from 20 kHz to 11.25 kHz for 2-slot) and in the case of requiring additional capacity in many areas of rural Pennsylvania where coverage is most difficult to achieve and high capacities are not required.
- The NPSPAC channels are spaced at 12.5 kHz between channel centers, while the interleaved public safety channels are spaced at 25 kHz. Both of these channel spacings permit a 20 kHz occupied bandwidth. This leads to the question of channels spacing of any repacked public safety spectrum. Also in question is the status of channels, other than the identified 70 public safety channels (outside of the border areas) that may currently be licensed to public safety agencies under inter-category sharing, or those licensed to B/LT licensees under a cooperative agreement with a public safety system.
- The border areas, of which the Commonwealth is impacted by Canada, add yet another dimension to the problem of providing contiguous and common spectrum in sufficient capacity to support the safety mission.
- We urge that the Commission not adopt across-the-board bandwidth requirements that make the provision of coverage in rural areas even more difficult at a time when Homeland Defense considerations require that rural areas receive no less in the way of service than dense urban areas.

Hybrid Public Safety Radio System Coverage **Contributions by Sites by Profile**

The following slides illustrate the relative contributions towards usable coverage in southeast Pennsylvania. The criteria used for prediction are: signal level >-102 dBm to a mobile radio with 3 dB gain antenna mounted 5' above ground level. (Note that this is representative of Pennsylvania's preliminary design, but has been changed since these predictions were made).

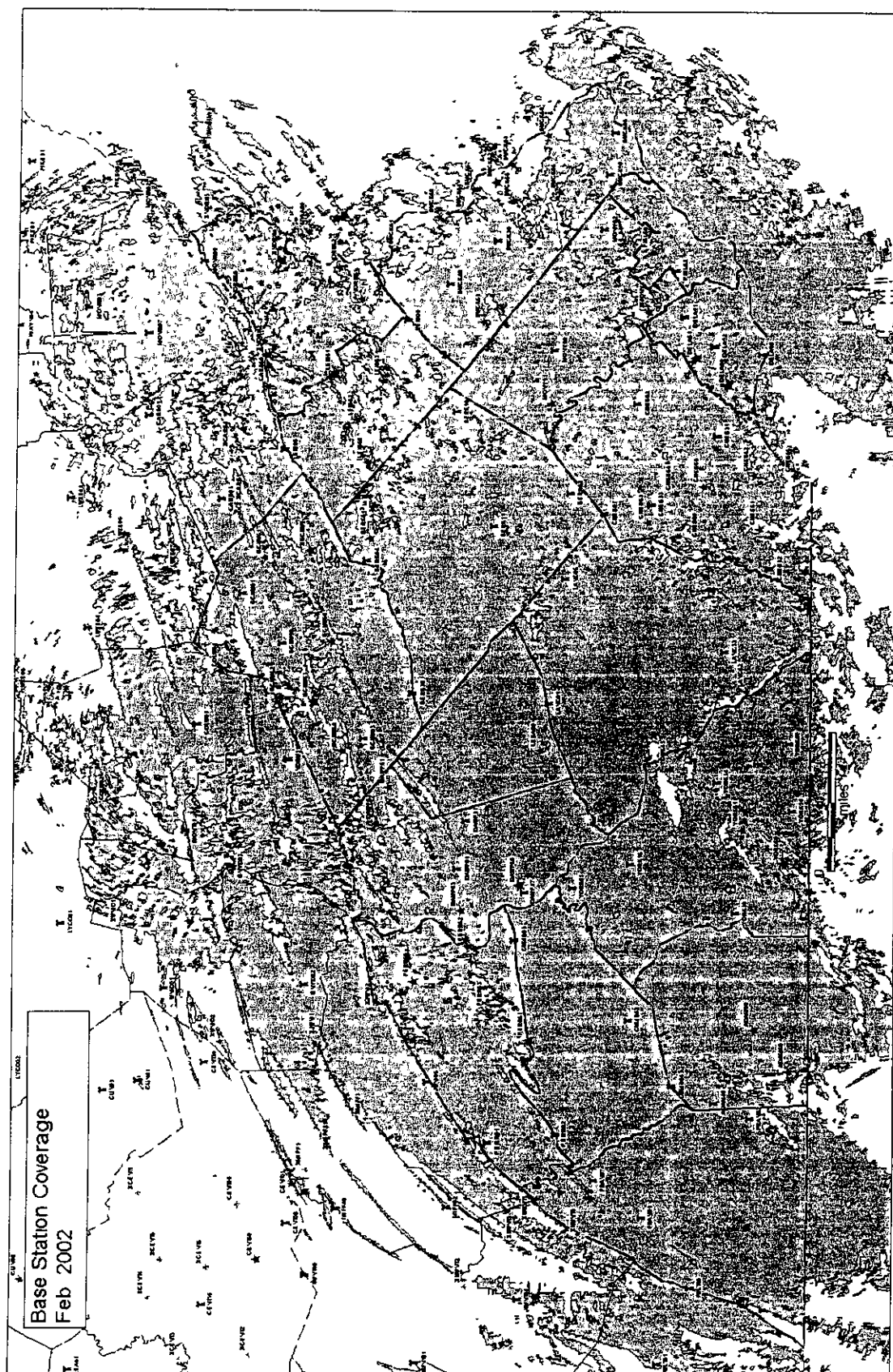
Slide 1, Base Station Coverage (page 12), illustrates the coverage contribution from the high-profile tower sites in this 17-county area. Base Station sites consist of multiple 70 watt transmitters, combined to a common antenna system with an ERP of approximately 100 watts. Contributing sites are marked by the tower icons.

Slide 2, Selected Candidates Coverage (page 13), illustrates the coverage contribution from the low-profile sites in this area. All of these sites have antenna heights less than 90'. Low-profile sites are marked by star icons.

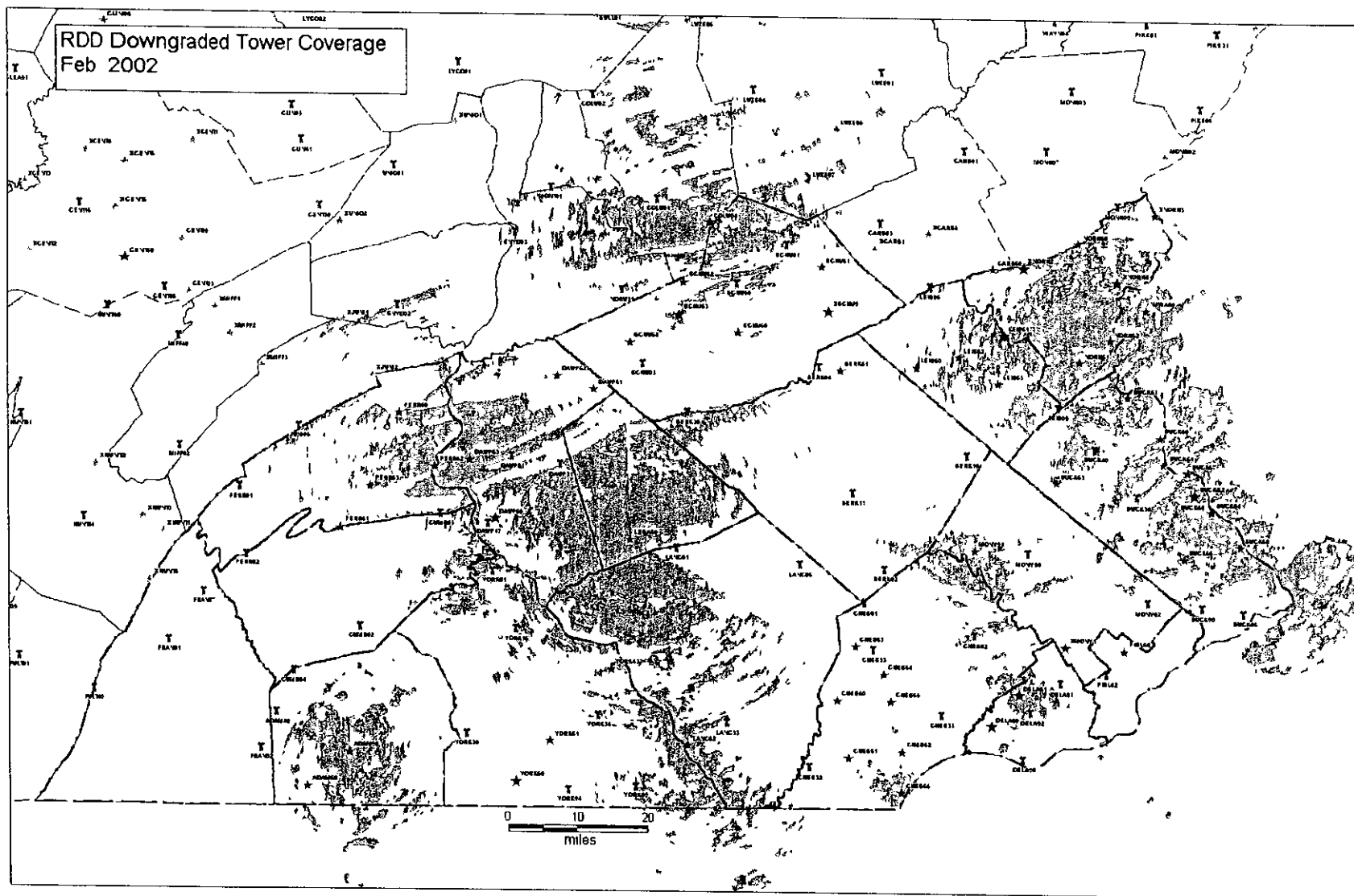
Slide 3, RDD Downgraded Tower Sites (page 14), illustrates the coverage contribution from smaller existing state-owned towers with insufficient capacity to carry elaborate antenna networks or microwave antennas. These sites were changed in the Regional Design Document (RDD). These may be considered as low-profile sites also, as all have antenna heights less than 150'.

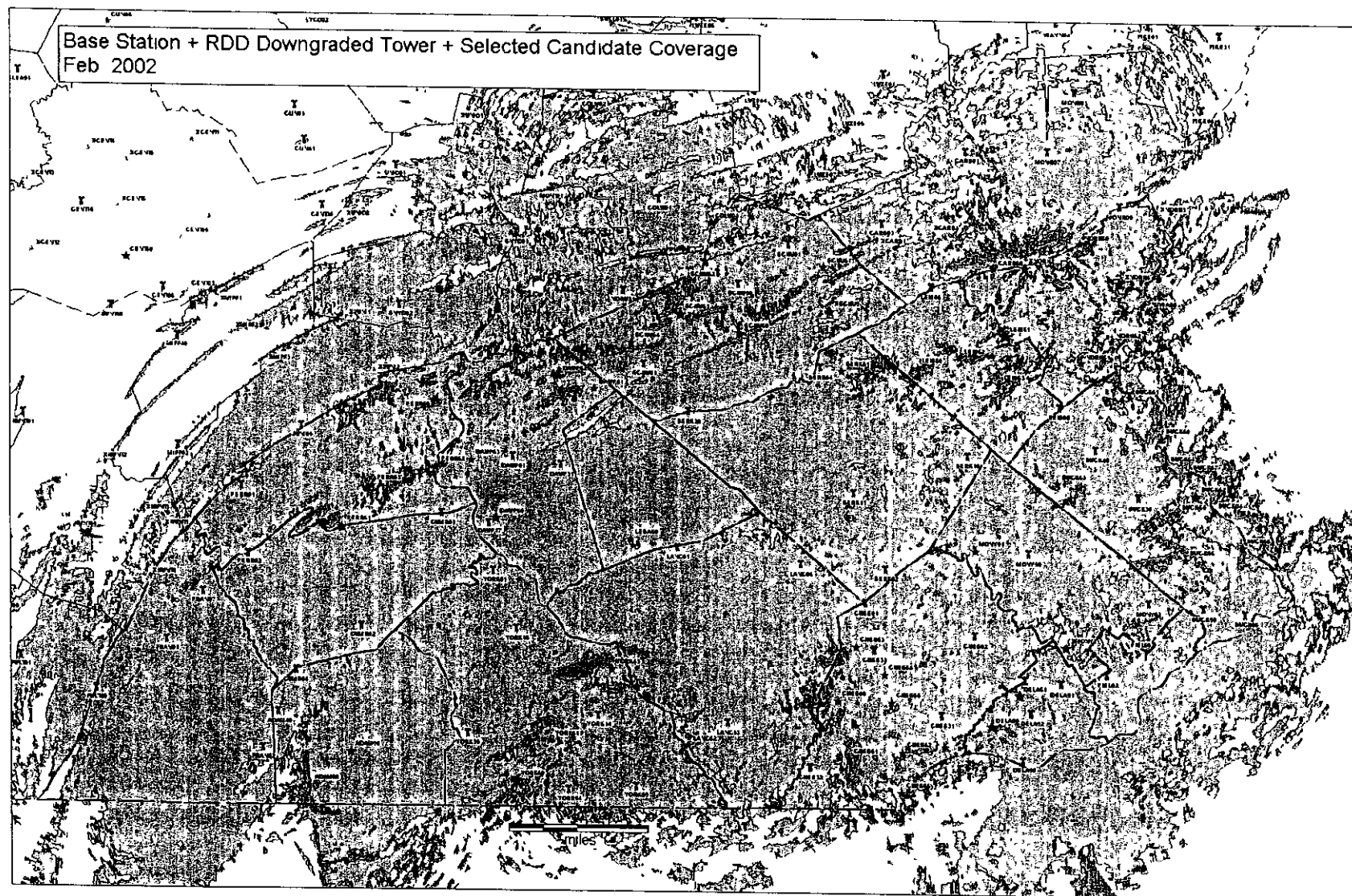
Slide 4 (page 15) represents the composite coverage in this 17 county region from both the high- and low-profile contributors. Note that the majority of the coverage and capacity is provided by the (purple) high-profile sites, as one expects from a traditional public safety system. Coverage contribution from the low-profile / low-ERP sites is evidenced by the green and orange coloring. The low-profile sites fill coverage gaps caused by terrain or by less-than-optimal tower site location without the need for elaborate site equipment, additional towers, or (most importantly) without extensive use of additional spectrum.

Since the time of this design iteration, additional steps have been taken to further reduce the spectrum usage of low-profile sites through the use of both directional and downtilt antennas and ERP reductions. The use of downtilt antennas at low profile sites has not generated any complaints of interference from other co-band users.

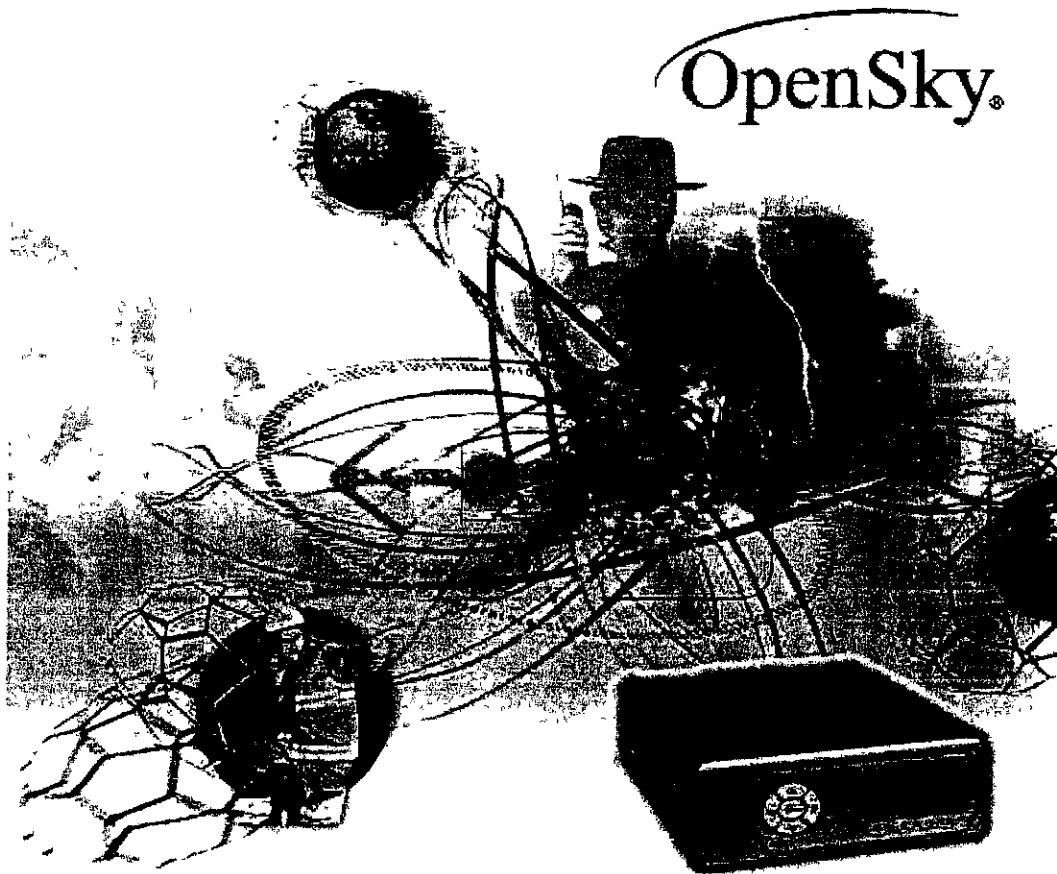








Technical Brief



NexTel Interference (Initial Findings)

tyco
Electronics

MACOM

This is an excerpt of a study that is being conducted by M/A-COM to evaluate the effects of Nextel systems on M/A-COM's public safety radio systems. The following is preliminary data from this study.

This chart shows the upper SMR spectrum close to a Nextel monopole site located in Cumberland County, PA approximately 4 miles west of Harrisburg adjacent to Highway 561. Typical of most Nextel sites, this site includes three directional antenna segments. The data that follows was collected on the antenna segment that broadcasts primarily away from the highway toward a commercial parking lot.



Spectrum data was collected with a Grayson Measurement System scanning the band from 860.0125 MHz to 868.9875 MHz in 12.5 kHz steps. This measurement system provides high-speed channel scanning capability with a very high performance receiver.

The orange spectrum shows the actual measured power intercepted by a quarter wave antenna mounted on top of the test vehicle. Three channels 863.0625, 864.0875, and 865.3625 MHz have each been identified as Nextel emitters with intercepted power of greater than -40 dBm in the local vicinity.

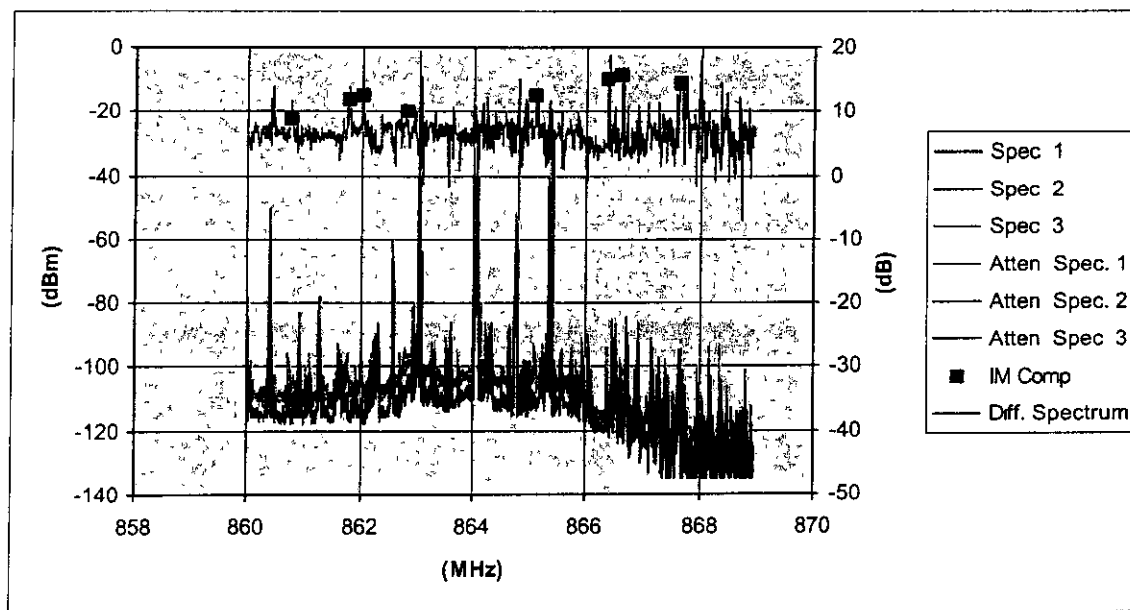
Two primary sources of interference were suspected from the Nextel tower. Sideband energy is the unintended emissions of energy outside the channel bandwidth. This energy increases the noise floor of a victim channel. The second source of interference is a

result of intermodulation, which results from the mixing of two or more strong emitters to produce interference energy at another frequency. The magenta spectrum shows a second sweep of the same band with 5.5 dB of attenuation placed in front of the measuring receiver. These two spectrums provide some discrimination between sideband noise and intermodulation interference.

Several interesting conclusions can be drawn from this data. The noise floor in the vicinity of this Nextel site is between -105 and -110 dBm this level is 15 to 20 dB above thermal noise and substantially reduces the performance of noise limited wireless systems. Urban sites with lower antenna heights have shown noise floors as much as 20 dB higher than these levels.

The public safety or NPSPAC band begins at 866 MHz. From 865.5 MHz to 867.5 MHz the apparent noise floor (as observed by the lowest noise channels) drops by 10 dB per MHz. This characteristic is consistent with the Nextel common practice of using hybrid combiners rather than selective combining. Traditionally SMR and NPSPAC operators employ fixed or automatic tuning combiner that substantially reduce (>30 dB) off channel emissions.

A frequent claim of Nextel is that intermodulation plays a dominant role in interference. While it is true that interference is certainly generated at the intermodulation frequencies, sideband energy interferes with many more channels than does intermodulation. For this example of three emitters above -50 dBm, nine third order intermodulation products were found to fall within the scanned band. Sideband noise however, appears to damage the noise floor of nearly the entire band (~500 channels.)



The difference spectrum shows the difference in power between consecutive measurements with and without 5.5 dB of antenna attenuation. Third order intermodulation components are reduced at 3 times the rate of linear interference

components or channel operators. The difference spectrum shows that the vast majority of the scanned band shows a ~6 dB difference as expected. Also, as expected 7 of 9 IM component frequencies show a 10 – 17 dB difference in interference level. Large magnitude peaks in the difference spectrum near the Nextel carriers are associated with noise in the measurement post processing.

This initial data shows that Nextel sites significantly damage the performance of public safety radio systems by raising the noise floor as much as 20 – 25 dB and sometimes as much as 35 – 40 dB. Particularly in urban areas where sites are deployed in a very tight frequency reuse plan, with antenna down tilt, and short tower heights substantial interruption of vital public safety communications can be expected.

Commonwealth of Pennsylvania Statewide Radio Network System Deployment 6-24-2003

